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VIVIPAROUS OPHIDIOID FISH GENUS
CALAMOPTERYX: NEW SPECIES FROM
WESTERN ATLANTIC AND GALAPAGOS

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Since the appearance of the original description of *Calamopteryx goslinei* as a new genus and species (Böhlke and Cohen, 1966), additional material of *C. goslinei* and of two unnamed species has come to hand. In this paper I present revised and supplementary diagnostic and descriptive data for the genus, original descriptions for the two heretofore unknown species, and additional descriptive and distributional data for *C. goslinei*.

Calamopteryx Böhlke and Cohen

The following characters in the original generic diagnosis require comment. The description of the male intromittent organ was based on immature specimens; in adults it consists of a variously developed fleshy postanal pad (Figure 1), and the penis, enclosed by an elongate hood which is continuous at its base on each side with a compressed lappet (clasper?). Caudal fin rays eight or 10 rather than always 10. Dermal papillae not always prominent, weak and sparsely distributed in one of the new species. Developed gill rakers two or three rather than always two.

Other characters common to the three species include the following. Hypurals two. Abdominal vertebrae 10 or 11. Parietals separated by supraoccipital. Lower angle of preopercle with a curved, anteriorly-directed spine. Pseudobranch absent. Teeth not all tiny and granular, some enlarged. No median basibranchial tooth patch; paired tooth patches at the base of gill arches three and five. Head squamation incomplete. Pyloric caecae two.

C. goslinei was found to be unique among 12 species of viviparous ophidioids examined in having spermatozoa free rather than contained

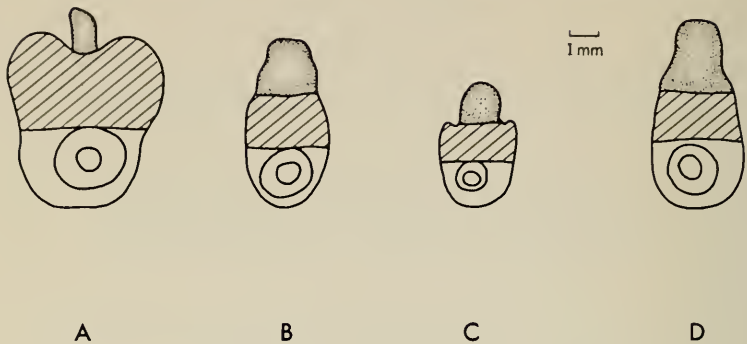


FIG. 1. Ventral view (anterior to the bottom) of genital area of δ in three species of *Calamopteryx*. A, *jeb*, FMNH 71604, 55.4 mm SL; B, *goslinei*, USNM 198218, 38.2 mm SL; C, *goslinei*, ANSP 120409, 78.6 mm SL; D, *robinsorum*, UMML 22293, 36.2 mm SL. Stippled region at top is hood enclosing penis, hatched area is fleshy pad, circle is vent. Penis and claspers not shown.

TABLE 1.—Selected characteristics of three species of *Calamopteryx*.

	<i>goslinei</i>	<i>robinsorum</i>	<i>jeb</i>
Caudal fin rays	10	8	10
Anal fin rays ¹	51–57	40–49	46–50
Relative eye size ²	intermediate 6.1–7.6 in hl	large 5.2–7.5 in hl	small 7.5–10.9 in hl
Relative pre-anal length ³	short 1.8–2.0 in SL	long 1.6–1.7 in SL	short 1.7–2.0 in SL
Papillae on head	prominent	weak and sparse	prominent ⁴
Genital pad of δ ⁵	little broader than hood over penis, lobes small or lacking	as in <i>goslinei</i>	much broader than hood over penis, with prominent lobes
Distribution	tropical western Atlantic	tropical western Atlantic	Galapagos
Depth	6 m or less to 55 m	64 to 210 m or more	to 25 m

¹ See Table 2.

² See Figure 2 and Table 3.

³ See Figure 3 and Table 4.

⁴ See Figure 6.

⁵ See Figure 1.

TABLE 2.—Counts in three species of *Calamopteryx*.

	Anal fin rays																		
	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	
<i>goslinei</i>													2	16	4	3	6	—	1
<i>robinsorum</i>	2	1	1	1*	2	1	1	2	2	1									
<i>jeb</i>							2	3	10	13*	4								
	Dorsal fin rays																		
	58	59	60	61	62	63	64	65	66	67	68	69	70						
<i>goslinei</i>							1	1	3	2	6	9	11	7					
<i>robinsorum</i>	2	—	—	2*	1	2	1	—	1	1	1								
<i>jeb</i>								2	2	10*	6	6	1						
	Pectoral fin rays																		
	13	14	15	16	17	18	19												
<i>goslinei</i>	7	20	7	—	1														
<i>robinsorum</i>		3*	4	4	4	—	1												
<i>jeb</i>			2	11*	21	2	1												
	Vertebrae																		
	37	38	39	40	41	42	43	44	45	46									
<i>goslinei</i>		1	—	—	4	6	9	4	—	1									
<i>robinsorum</i>	3	3*	5	1	2	1													
<i>jeb</i>				3	14*	14	4												

* Holotype.

in spermatophores (Nielsen et al., 1968). Both of the species described as new in this paper have spermatophores (Nielsen, in litt.).

Species: The three species of *Calamopteryx* may be distinguished by means of the characters contrasted in Tables 1, 2, 3 and 4 and Figures 1, 2 and 3.

Distribution and habitat: The genus is apparently restricted to the New World tropics. *C. jeb* thus far has been caught only at the Galapagos Islands, where it has been taken with rotenone from rocky areas at depths to 25 m. Although extensive collecting of appropriate habitats along tropical Pacific shores of Central America has failed to reveal *jeb* (W. Bussing, R. Rosenblatt, personal communications) it eventually may be found there, as was true of *Oligopus diagrammus* and *Petrotyx hopkinsi*, two other species of shallow-water ophidioids originally described from the Galapagos and with congeneric relatives in the Caribbean.

C. goslinei and *robinsorum* are both tropical western North Atlantic species (see Figure 4); however, they live at different depths. *C.*

TABLE 3.—Frequency diagram of HL/Eye ratio in three species of *Calamopteryx*.

	<i>robinsorum</i>	<i>goslinei</i>	<i>jeb</i>
5.2	1		
5.4	1		
5.6	—		
5.8	—		
6.0	4	3	
6.2	—	2	
6.4	2	4	
6.6	1	5	
6.8	2	2	
7.0	1	3	
7.2	1	2	
7.4	1	2	2
7.6		1	2
7.8			6
8.0			3
8.2			6
8.4			3
8.6			3
8.8			1
9.0			—
9.2			3
9.4			1
9.6			1
9.8			1
10.0			—
10.2			—
10.4			1
10.6			—
10.8			1

robinsorum is a deeper living species and has been trawled from known depths ranging between about 64 and 210 meters. *C. goslinei* has been taken only with rotenone from reef areas, at depths ranging from 6 m or less to 55 meters.

Species relationships: The three species of *Calamopteryx* vary in a mosaic of characters summarized in Table 1. I believe that the resemblances of parts of the male copulatory apparatus in the two western Atlantic species (see Figure 1) is fundamental, and outweighs the several similarities shared by the ecological analogues *goslinei* and *jeb*, which may have been independently selected for.

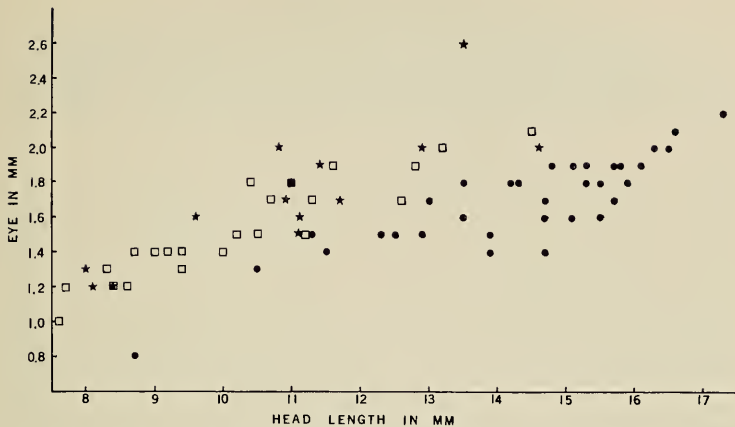


FIG. 2. Relationship of eye diameter to head length in three species of *Calamopteryx*. Star = *robinsorum*; square = *goslinei*; circle = *jeb*.

Calamopteryx jeb, new species

Figures 5, 6

Description: Counts are given in Table 2. Measurements in percent of SL for 20 to 25 specimens ranging in SL from 30.3 to 54.8 mm. Mean first, followed by range in parentheses: greatest body depth 20.0 (18.6–21.8); predorsal length 37.0 (35.0–38.5); preventral length 23.6 (22.2–28.1); preanal length 55.0 (51.1–58.5); head length 28.8 (27.6–30.4); eye diameter 3.3 (2.6–3.9); snout length 5.7 (5.2–6.3); pigmented interorbital 4.2 (3.6–5.1); upper jaw length 14.1 (13.2–15.3); ventral fin length 15.2 (10.8–18.5); pectoral fin + pectoral peduncle length 21.9 (20.2–23.5); pectoral fin length only 17.0 (14.5–19.3); least width pectoral peduncle 5.0 (4.3–5.5); ventral fin base to symphysis of cleithra 4.5 (3.6–5.3).

Body relatively short and stubby, most specimens lacking the pronounced nuchal rise common in *C. goslinei*.

TABLE 4.—Frequency diagram of SL/Pre-anal ratio in three species of *Calamopteryx*.

	1.6	1.7	1.8	1.9	2.0
<i>robinsorum</i>	1	9	—	—	—
<i>jeb</i>	—	4	13	6	1
<i>goslinei</i>	—	—	7	12	6

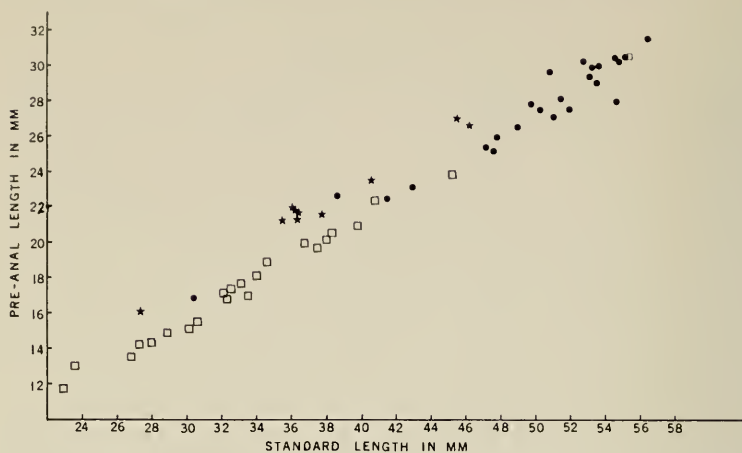


FIG. 3. Relationship of preanal length to standard length in three species of *Calamopteryx*. Star = *robinsorum*; square = *goslinei*; circle = *jeb*.

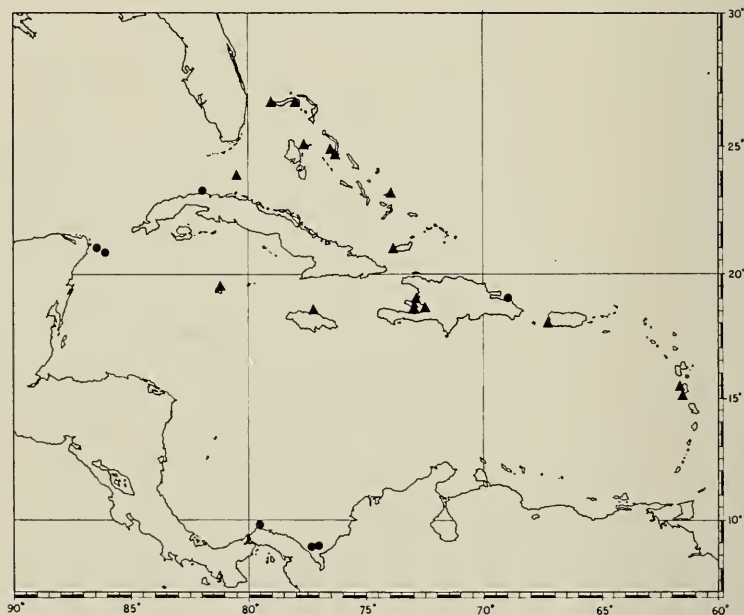


FIG. 4. Distribution of two species of *Calamopteryx* in the western N. Atlantic. Circle = *robinsorum*; triangle = *goslinei*.

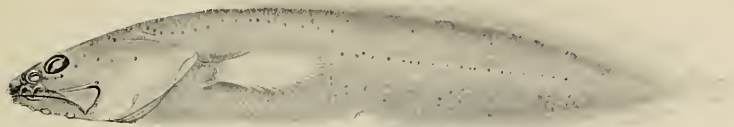


FIG. 5. *Calamopteryx jeb*, holotype, FMNH 71603, 53.2 mm SL. Drawn by Mildred H. Carrington.

Head compressed; snout not notably depressed as in *C. goslinei*, broadly rounded. Jaws subequal, but the fleshy snout projecting beyond the jawbones. Eyes elliptical, directed laterally, covered by a transparent spectacle. Anterior nostril a prominent, stiffened tube located over the upper lip; posterior nostril circular, with a raised rim directed postero-laterally, slightly closer to eye than to anterior nostril. Width of pigmented interorbital greater than eye diameter. Dorsal rim of maxillary sheathed for most of its length, but expanded rear part free.

Head with prominent papillae and raised flaps (buried in mucous in some specimens), which are most numerous on the snout and the lower surface of the head; most specimens with a particularly notable flap at the tip of the upper lip. Sensory pores large: lateral canal 1; supraorbital 1; suborbital 3; preopercular-mandibular 7. Small white papillae in two series on the side of the body (see Figure 5), 12 to 20 in the upper row and 21 to 26 in the lower (which does not reach the base of the caudal fin).

Gill rakers on first arch in the form of several flat spiny pads on the upper arm, a spiny tubercle at the angle, followed by 2 or 3 similar tubercles and 5 to 7 pads on the lower arm.

Premaxillaries with a lateral narrow band of minute granular teeth which is broader near the tip of the jaw, and medially a widely-spaced series of larger, sharply pointed teeth; near the tip of the upper jaw 3 to 5 closely spaced larger teeth posterior to the granular teeth. Vomerine teeth in a broadly U-shaped double series, on each side a single row of very small teeth in front, a row of 2-5 larger teeth behind. Palatines bearing a continuation of the vomerine series, with small teeth in a row 1 to several teeth wide laterally, and 6 to 10 larger teeth medially. Dentary with a double series of teeth extending the length of the jaw, a narrow band of minute granular teeth laterally, the other series a widely spaced row of 10 to 20 longer sharp pointed teeth.

Scales on top of head in a patch which extends forward to about the level of the hind margin of the orbits, bounded laterally by a naked streak over the lateral canal. On the side of the head, scales cover the opercular region and the cheek; the most anterior and posterior head

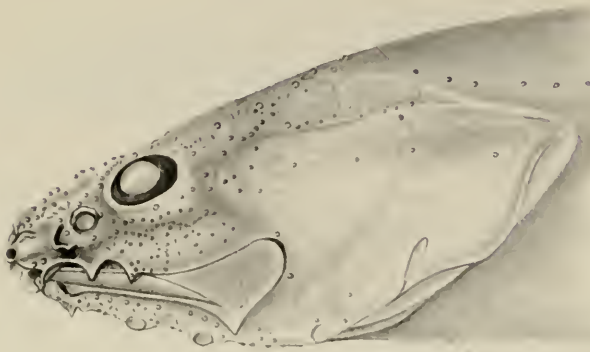


FIG. 6. *Calamopteryx jeb*, head of holotype. Drawn by Mildred H. Carrington.

scales largest. Head naked ventrally, around the orbits and on the snout. Lateral scale rows along the body, 75 to 80 in 16 specimens.

Male intromittent organ consisting of a prominent fleshy pad (Fig. 1A) extending posteriorly from the vent, which has 2 to 5 lobes along its hind margin. From the center of the hind margin (or from slightly inside of it) extends an elongate hoodlike structure, supported on each side by a cartilaginous (?) rod (in some specimens one or both rods have come free from the skin of the hood and resemble a pair of claspers or an independent papilla), which is continuous at its base with an expanded flattened lappet, the pair of which encloses a small penis at the base of the hood.

Pyloric caecae 2 broad protuberances.

Color in alcohol varying from straw to dark brown-purple, belly and ventral part of head pale; heavier pigmentation along the bases of the dorsal and anal fins, a light spot at the base of the caudal fin. Many of the more lightly pigmented specimens have two or three indistinct brown lines radiating posteriorly from the orbit.

Etymology: The name *jeb* is coined from the initials of James E. Böhlke, noted ichthyologist and co-describer of the genus *Calamopteryx*.

Study material: All from the Galapagos, collected with rotenone.

ALBEMARLE ID. HOLOTYPE: FMNH 71603, ♀, 53.2 mm SL, 1 mile N of Tagus Cove, open lava reefs, surge surf and pools, 0–5 m, "Te Vega" cr. 13, 26 Feb., 1967. All of the following (from all islands) PARATYPES: FMNH 71640 (24), data as for holotype. USNM 208339 (1), 0°14'27" S, 91°23'22" W, rocky promontory, 0–3 m, "Anton Bruun" cr. 16, st. HA-114-24. USNM 208340 (6, including 2 cleared and stained) and

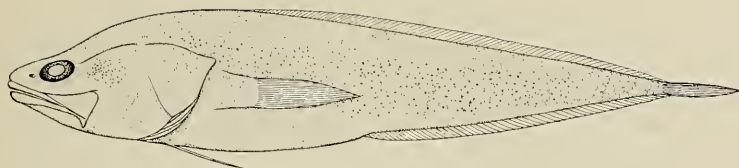


FIG. 7. *Calamopteryx robinsorum*, a composite picture modified from an 1888 drawing of USNM 39494, found in the files of the USNM Division of Fishes. Head pores not shown. Original artist unknown, modified by Keiko H. Moore.

ZMUC (2), one-half mile NW of Tagus Cove rock area along shore, 1–15 m. “Anton Bruun” cr. 16, st. 66132.—BALTRA ID. USNM 208342 (2), 0°26'01.5" S, 90°17'0.6" W, cove at angle formed by shore and boat landing, 0–5 m, “Anton Bruun” cr. 16, st. HA-106.—BARRINGTON ID. UCLA W64-32 (3), cove on NE shore, lava rock, 12–15 m.—HOOD ID. UCLA W67-39 (3), north side, rocks, 5 m.—INDEFATIGABLE ID. W64-38 (11), north coast, small cove in South Channel, rock and coral, 2–9 m. W64-37 (37), north coast, South Channel, rock and coral, 3–8 m. W64-21 (14), Academy Bay, W. side of entrance, rocks, 0–9 m.—NARBOROUGH ID. USNM 208341 (5), Espinosa Pt., one-half mile offshore, 10–25 m, “Anton Bruun” cr. 16, st. 66138. UCLA W53-162 (1), tidepool, 0–2 m. UCLA W64-10 (21), 1 mi. S Espinosa Pt., rock, 1–5 m. UCLA W64-9 (1), 3 mi. SE Espinosa Pt., rock, 3–5 m. UCLA W64-3 (6), 1 mi. S Espinosa Pt., rock, 0–5 m.

***Calamopteryx robinsorum*, new species**

Figure 7

Description: Counts are given in Table 2. Measurements in percent of SL for 7 to 12 specimens ranging in SL from 26.9 to 46.2 mm. Mean first, followed by range in parentheses: greatest body depth 19.3 (18.0–21.2); predorsal length 37.5 (34.4–40.7); preventral length 25.5 (22.1–28.2); preanal length 68.9 (57.0–60.7); head length 30.6 (29.2–32.2); eye diameter 4.8 (4.1–5.6); snout length 6.0 (5.0–7.3); pigmented interorbital 4.3 (3.3–5.2); upper jaw length 15.0 (13.8–16.0); ventral fin length 12.4 (9.8–15.2); pectoral fin + pectoral peduncle length 22.7 (19.1–25.3); pectoral fin length only 18.3 (14.1–20.9); least width pectoral peduncle 4.2 (3.9–4.4); ventral fin base to symphysis of cleithra 5.4 (4.9–6.2).

Body relatively short and stubby, a pronounced nuchal rise in the largest specimen only. Head depth behind eyes about equal to or slightly less than head width; snout depressed, broadly rounded. Lower jaw slightly inferior, snout slightly inflated but no projecting fleshy area. Eyes elliptical, directed dorso-laterally, covered by a transparent spectacle.

Anterior nostril a thin-walled tube located over the upper lip (not shown on Fig. 7); posterior nostril circular, closer to eye than to anterior nostril. Width of pigmented interorbital equal to or slightly less than eye diameter. Dorsal rim of maxillary sheathed, barely so posteriorly.

Head with only a few weak papillae. Sensory pores difficult to discern in the thin, tissue-like head skin, probably distributed as in *C. jeb* and *C. goslinei*. Lateral line papillae few, counts not possible.

Gill-rakers on first arch in the form of several flat spiny pads on the upper arm, a spiny tubercle at the angle, followed by 2 or 3 similar tubercles and 4 to 6 pads on the lower arm.

Dentition of premaxillaries a band of minute granular teeth, in some specimens a few of the innermost teeth are enlarged; 4 to 8 enlarged, sharp pointed teeth at the tip medial to the smaller ones. Vomerine teeth in a broadly U-shaped double series, on each side a single row to a narrow band in front, a row of 2 to 6 larger teeth behind. Palatines bearing a continuation of the vomerine series, with small teeth in a single row or narrow band laterally, and 4 to 10 larger teeth medially. Dentary with a double series of teeth extending the length of the jaw, a single row or narrow band of minute granular teeth laterally; medially a widely spaced row of 10 to 20 larger, sharp-pointed teeth.

Head squamation similar to that in *C. jeb* and *C. goslinei*, but scales very thin and transparent, largest scales on opercle. Lateral scale rows difficult to count, probably 50 to 60.

Male intromittent organ similar to that of *C. goslinei*. Fleshy pad described for *C. jeb* is reduced or essentially lacking (Fig. 4D), the most prominent structure being an elongate hood which encloses a small penis and is continuous at its base on each side with an expanded flattened lappet.

Pyloric caecae represented by 2 broad bumps.

Color in alcohol pale straw; large, widely spaced brown chromatophores along the sides but absent along the bases of the median fins; more densely distributed on the cheeks and over the top of the post-orbital part of the head, but absent over the lateralis canals.

Distribution: Western Caribbean, north coast of Cuba, northeast coast of Hispaniola (see Figure 4).

Etymology: Named for Dr. C. Richard Robins and Dr. Catherine H. Robins in recognition of their contributions to knowledge of the taxonomy of western Atlantic fishes.

Study material: All from the tropical western Atlantic. HOLOTYPE: USNM 209256, ♀, 40.5 mm SL, 9°38.9' N, 79°15.3' W to 9°40.2' N, 79°17.4' W, 64–70 m, 10' otter trawl, "Pillsbury" st. 425, 19 July, 1966. PARATYPES: ANSP (1), 8°50' N, 77°02' W, 73 m, 10' otter trawl, "Pillsbury" st. 402, 17 July, 1966. UMML 22293 (3), 8°48' N, 77°13' W, 97–99 m, 10' otter trawl, "Pillsbury" st. 403, 17 July, 1966. USNM 209257 (4), 19°03.1' N, 68°47.2' W, 84–110 m, "Pillsbury" st. 1158, 16

Jan. 1970. USNM 39494 (2), 23°10'54" N, 82°17'45" W, 210 m, tangles over coral bottom, "Albatross" st. 2322, 17 Jan. 1885. USNM 209258 (2) and ZMUC (2), 21°05' N, 86°23' W, 146–265 m, 10' otter trawl, "Pillsbury" st. 581, 22 May, 1967. ANSP (1), 20°57' N, 86°34' W, 40–165 m, 10' otter trawl, "Gerda" st. 899, 30 Sept. 1967.

Calamopteryx goslinei Böhlke and Cohen

See Table 2 for a supplement to counts given in the original description. Data on eye size, head length and preanal length presented in Figures 1, 2 and 3 and Tables 3 and 4 were taken in part from type-material and in part from more recently collected specimens listed below.

Male intromittent organ similar to that of *C. robinsorum*, in that the elongate fleshy hood enclosing the penis is the most prominent structure and the basal fleshy pad is not inflated or greatly expanded laterally. Other variation is present, for example in the largest specimen (Fig. 1C) the pad has two small lobes.

Pyloric caecae two hemispherical protuberances.

Dentition in new material much as in original description, but in some specimens, a few of the inner teeth along the band of otherwise granular premaxillary teeth, are slightly enlarged.

One new specimen (ANSP 120409, from Eleuthera, Bahamas) agrees with other specimens in most respects but differs in its greater size, 78.6 mm SL (vs. 55.7), its regular row of evenly spaced enlarged teeth along the inside of the premaxillary tooth band (see above) and its high number of dorsal fin rays, 76 (vs. 63–70, see Table 2).

Distribution: Probably widespread throughout the Antilles, also taken at Grand Cayman and Jamaica (see Figure 4).

Study material: The type-material was re-examined and 1 paratype (ANSP 106701, 12.7 mm SL) was redetermined as a juvenile *Ogilbia*. Additional material: JAMAICA, Discovery Bay, UMML 30231 (1), 27 m; all of the following ANSP: GRAND BAHAMA, 117339 (1), 41 m.—NEW PROVIDENCE, 120407 (1), 16–19 m.—ELEUTHERA, 120409 (1), 27–31 m and 111926 (7), 9–12 m.—SAMANA KEY, 115204 (1), 30–34 m.—GREAT INAGUA, 120410 (1), 30–37 m.—HAITI: Gulf of Gonave, 120408 (2), 35–39 m, 114403 (1), 26–30 m, 111392 (1), 37–41 m, 119119 (2), 1–6 m, 120512, 18–20 m; Port-au-Prince Bay, 112520 (3), 18–24 m.

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